भारतीय मानक
Indian Standard

IS 5852 (Part 1) : 2019

पैरों की सुरक्षा के लिए पंजाटोपी — विशिष्टि

भाग 1 धातु के पंजा टोपी

(पाँचवा पुनरीक्षण)

Toe Caps for Protection of Feet — Specification

Part 1 Metallic Toe Caps

(Fifth Revision)

ICS 13.340.50

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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Footwear Sectional Committee, CHD 19

FOREWORD

This Indian Standard (Part 1) (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Footwear Sectional Committee had been approved by the Chemical Division Council.

Toe caps are necessary components of safety and protective footwear and they provide protection to the wearer against accidents that might occur at work or during day to day activities.

This standard was first published in 1970 as IS 5852 : 1970 'Protective steel toe caps for footwear' and was subsequently revised in 1977, 1992, 1996 and 2004. In the original standard, C-60 carbon steel along with its composition was recommended as raw material for the manufacture of protective steel toe caps. Hardness also was recommended at 400 – 500 HV at 10 kg load.

In the first revision composition of raw material was deleted and hardness value was revised to 300 – 450 HV at 30 kg load. In the second revision, hardness requirement was deleted and raw material thickness and performance value of Type 2 protective steel toe cap for safety footwear was raised.

In the third revision, dimensional requirement, methods of test for performance value of Type 2 protective steel toe cap for safety footwear were revised. In the fourth revision, emphasis was given to upgrade the standard in line with the industries' requirement. Accordingly, several experimental studies were conducted and based on these studies some requirements were revised as follows:

a) Thickness requirement was deleted;
b) Dimensional requirements of '*a*' and '*b*' were deleted;
c) Size-wise performance values (clearance) were made specific; and
d) Performance test method was revised by incorporating plasticine cylinders in place of metal capsules.

Since design of toe caps has undergone changes in the recent years and currently both metallic and non-metallic toe caps are commercially available, the Footwear Sectional Committee, decided to align the standard in view of developments in this field. Thus, both metallic and non-metallic toe caps have been included and the original standard has now been split into two parts. This part deals with metallic toe caps and supersedes IS 5852 : 2004, while Part 2 deals with non-metallic toe caps.

In the earlier version of this standard, that is, IS 5852 : 2004, two types of metallic toecaps were prescribed, one for footwear having leather soles and one for footwear having rubber/moulded soles. In this standard, this classification has been removed and the requirements of toecaps have been specified for safety and protective footwear. Other changes made in this standard with respect to the earlier version, IS 5852 : 2004, are given below:

a) This standard has been aligned with ISO/DIS 22568-1.
b) Requirement of corrosion resistance has been added.
c) Requirements of internal length and flange width have been revised.
d) Requirement and test for impact resistance has been revised.
e) Requirement and test for compression resistance has been added.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TOE CAPS FOR PROTECTION OF FEET — SPECIFICATION

PART 1 METALLIC TOE CAPS

(Fifth Revision)

1 SCOPE

This standard (Part 1) prescribes requirement and methods of sampling and test for metallic toe caps,used for reinforcement of the toe of the footwear.

2 REFERENCE

The standards listed below contain provisions which though reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards listed below:

IS No.	*Title*
2050 : 1991	Glossary of terms relating to footwear (*first revision*)
15298 (Part 1) : 2015	Personal protective equipment: Part 1 Test methods for footwear (*second revision*)
15298 (Part 2) : 2016	Personal protective equipment: Part 2 Safety footwear (*second revision*)
15298 (Part 3) : 2011	Personal protective equipment: Part 3 Protective footwear (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2050 shall apply. In addition, the following definitions shall also apply to the standard.

3.1 Internal Metallic Toecap — Metallic toecap intended to be incorporated underneath the upper of the footwear, to provide protection against mechanical impact and compression.

3.2 External Metallic Toecap — Metallic toecap intended to be incorporated on top of the footwear upper forepart, to provide protection against mechanical impact and compression.

4 REQUIREMENTS

4.1 Finishing

Metallic toecaps shall be finished in such way that they are smooth and without any surface marks or defects. The toecaps shall not have burrs and sharp edges.

4.2 Dimensions

4.2.1 *Internal Length*

When measured in accordance with the method described in Annex A, the internal length of metallic toe caps shall be not less than the values given in Table 1.

4.2.2 *Width of Flange*

If metallic toecaps are formed with a flange, the inside width of the flange (*e*) (*see* Fig B-1) shall not be greater than 10 mm when tested in accordance with the method given in Annex B.

4.3 Impact Resistance

When metallic toecaps are tested in accordance with the method described in Annex C at an energy level of either 100 J ± 2 J (for metallic toecaps intended for protective footwear), or 200 J ± 4 J (for metallic toecaps intended for safety footwear), the clearance under the cap during the impact shall be not less than the values given in Table 2. In addition, the metallic toecaps shall not develop sharp edges or any cracks passing through the material (that is, through which light can pass).

Table 1 Minimum Internal Length of Metallic Toecaps

(*Clause* 4.2.1)

Metallic toecap number	5 and below	6	7	8	9	10 and above
Minimum internal length in mm	34	36	38	39	40	42

NOTE — The above numbering system for toecaps is not identical to any sizing system for footwear.

Table 2 Minimum Clearance under Metallic Toecaps at Impact and Compression

(*Clause* 4.3 *and* 4.4)

Metallic toecap number	5 and below	6	7	8	9	10 and above
Internal metallic toecap minimum clearance (mm)	19.5	20.0	20.5	21.0	21.5	22.0
External metallic toecap minimum clearance (mm)	24.5	25.0	25.5	26.0	26.5	27.0

4.4 Compression Resistance

When metallic toecaps are tested in accordance with the method described in Annex D, the clearance under the metallic toecap at a compression load of either 10 kN ± 0.1 kN (for metallic toecap intended for protective footwear), or 15 kN ± 0.15 kN (for metallic toecap intended for safety footwear), shall not be less than the values given in Table 2. In addition, the metallic toecaps shall not develop sharp edges or any cracks passing through the material (that is through which light can pass).

4.5 Corrosion Resistance

Metallic toecaps shall not exhibit more than three areas of corrosion, none of which shall measure more than 2 mm in any direction, both before and after testing in accordance with the method given in Annex E.

5 MARKING

5.1 Metallic toecaps shall be clearly and permanently marked with the following information:

a) Metallic toecap number (*see* Table 1 and 2);
b) Left or right;
c) Manufacturer's identification mark;
d) Manufacturer's type designation;
e) **S** or **200 J** (metallic toecaps designed for safety footwear) **P** or **100 J** (metallic toecaps designed for protective footwear); and
f) Number of this standard and year of publication.

5.2 BIS Certification Marking

The toecaps may also be marked with the Standard Mark.

5.2.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

6 PACKING

The product shall be packed as agreed to between the purchaser and the supplier. Packing should bear suitable code number to identify the date of manufacture.

7 SAMPLING

The scale of sampling and the criteria for conformity of the product shall be as given in Annex F.

ANNEX A

(*Clause* 4.2.1)

DETERMINATION OF INTERNAL LENGTH OF METALLIC TOECAP

A-1 DETERMINATION OF TEST AXIS

Position the left metallic toecap with its rear edge in line with a base line and draw its outline. Repeat the exercise with the right metallic toecap of the pair, positioning it at the same base line in such a manner that the outlines at the toe end of both metallic toecaps coincide (*see* Fig. A-1).

Mark the four points, A, B, C and D where the outlines of the right and left metallic toecaps intersect on the base line. Construct the perpendicular from the base line at the midpoint of AB or CD. This constitutes the test axis of both metallic toecaps.

A-2 PROCEDURE

Place the metallic toecap, open side down, on a flat surface. With an appropriate gauge, measure the internal length *l*, along the test axis from the front inside to the vertical projection of the back edge between 3 mm and 10 mm above and parallel to the surface upon which the metallic toecap rests, taking the longest distance as the length *l* (*see* Fig. A-2).

A-3 TEST REPORT

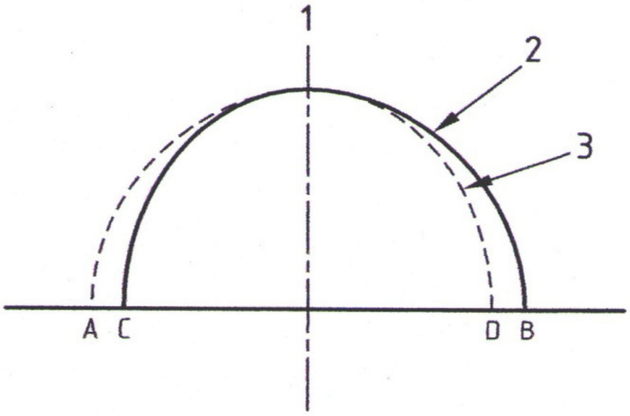
The report shall include the following information:

a) a reference to this standard [that is, IS 5852 (Part 1)];

b) all the details concerning the necessary information for the samples identification;

c) the internal lengths determined according to **A-2** for each size of measured metallic toecap; and

d) any deviation by agreement or otherwise from the present test method.

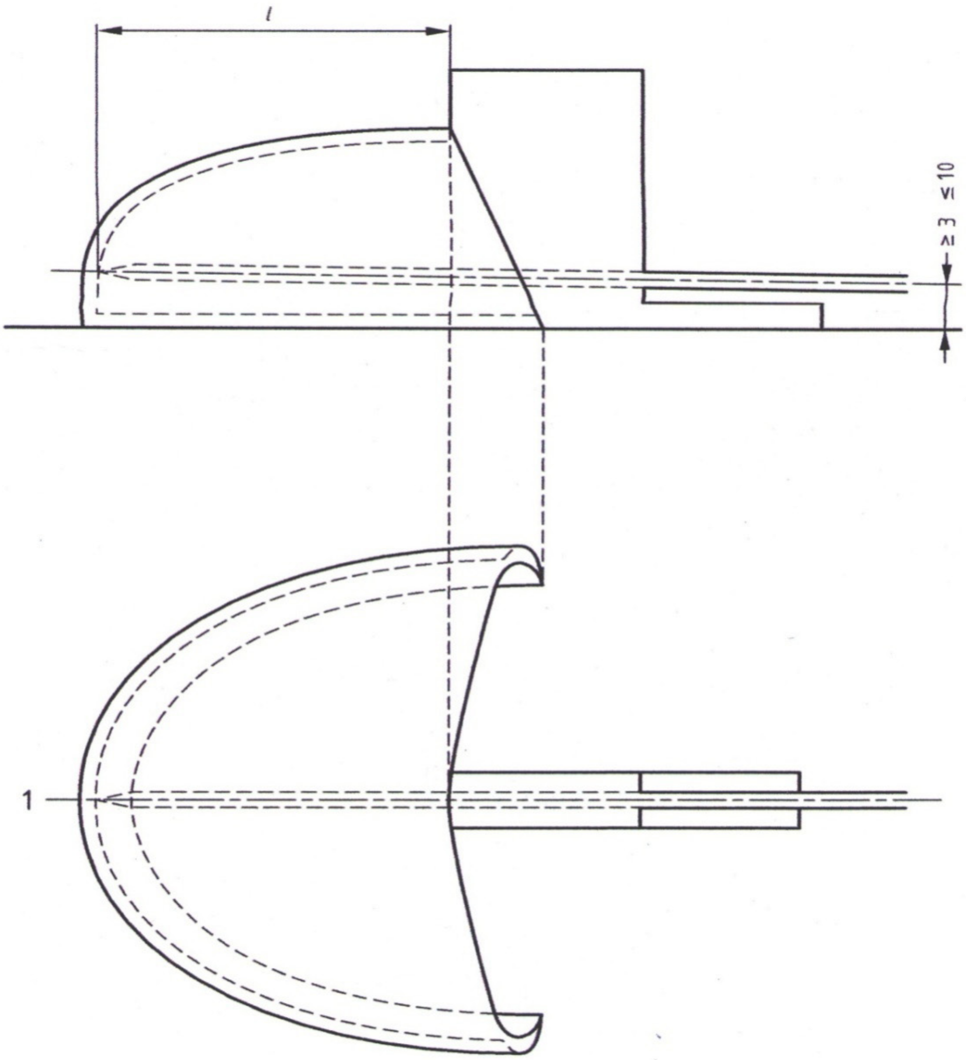


Key

1	Test axis
2	Right cap
3	Left cap
A, B, C, D	Points where the outlines of the right and left toe caps intersect on the base line

Fig. A-1 Determination of Test Axis (Schematic Illustration)

Dimensions in millimetres



Key

1 Test axis

l Internal length of the toe cap

Fig. A-2 Measurement of Internal Metallic Toecap Length

ANNEX B

(*Clause* 4.2.2)

DETERMINATION OF WIDTH OF FLANGE

B-1 WIDTH OF FLANGE

Determine the inside width of the flange (*e*) as shown in Fig. B-1.

B-2 TEST REPORT

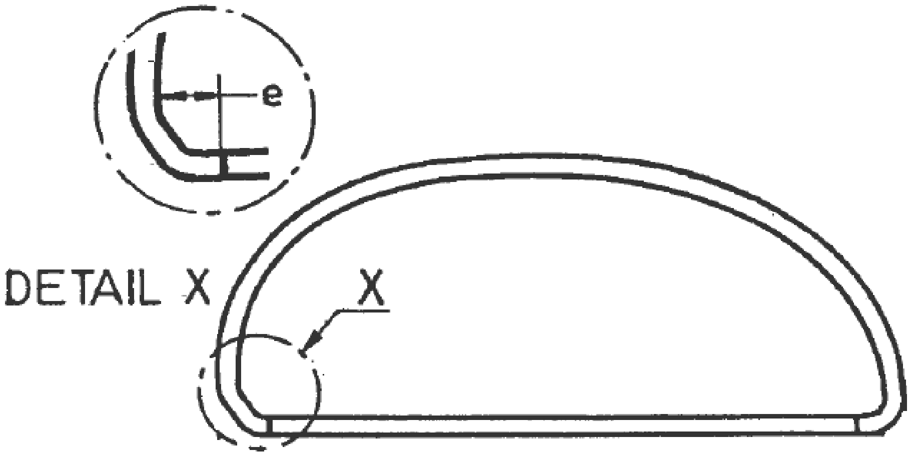
The report shall include the following information:

a) A reference to this standard [i.e. IS 5852 (Part 1)];

b) All the details concerning the necessary information for the samples identification;

c) The width of flange determined according to **B-1** for each size of measured metallic toecap; and

d) Any deviation by agreement or otherwise from the present test method.



Key

e Width of the metallic toecap flange

Fig. B-1 Illustration of Width 'E' of the Metallic Toecap Flange

ANNEX C

(*Clause* 4.3)

DETERMINATION OF IMPACT RESISTANCE

C-1 APPARATUS

C-1.1 Impact Apparatus

Incorporating a steel striker of mass 20 kg ± 0.2 kg adapted to fall freely on vertical guides from a predetermined height to give the required impact energy.

The striker (*see* Fig C-1) shall be made of steel with Rockwell hardness *Min*. 60 HRC and shall consist of a wedge at least 60 mm long, the rectangular faces of which are at least 40 mm in height and subtend an angle of 90º ± 1°. The apex where the faces meet shall be rounded to a 3 mm ± 0.1 mm radius. During the test the apex shall be parallel within ± 2° to the base of the clamping device.

The base of the apparatus shall be of compact design, avoiding elastic structures as far as possible. It shall have a mass of at least 600 kg and a metal block of dimensions at least 400 mm × 400 mm × 40 mm deep shall be bolted to it.

The apparatus shall be free standing on a flat and level floor which is sufficiently large and rigid to support the test equipment. Provision shall be made for a mechanism to arrest the striker after the first impact so that the test specimen is hit only once.

C-1.2 Clamping Device

Consisting of a steel platen at least 19 mm thick and 150 mm × 150 mm in area and of minimum hardness 60 HRC with provision for lightly clamping a metallic toecap in a way which will not restrict any lateral deformation of the cap during the impact test. An example of a suitable clamping device is shown in Fig. C-2.

The metallic toecap shall be held in position at the front end with a forked clamp which is fixed with a screw into one of the threaded holes, depending on the size of the metallic toecap.

The metallic toe cap shall be held at the rear end with a curved plate which is screwed to a sliding rail. The radiused plate lies over the flange at the back edges of the cap and pushes the cap against the forked clamp with a load of 100 N to 200 N.

The sliding rail is sprung such that when the metallic toecap is hit by the striker it can move back along its axis against the spring. To change the metallic toecap the curved plate is retracted by releasing the clamping handle.

Dimensions in millimetres

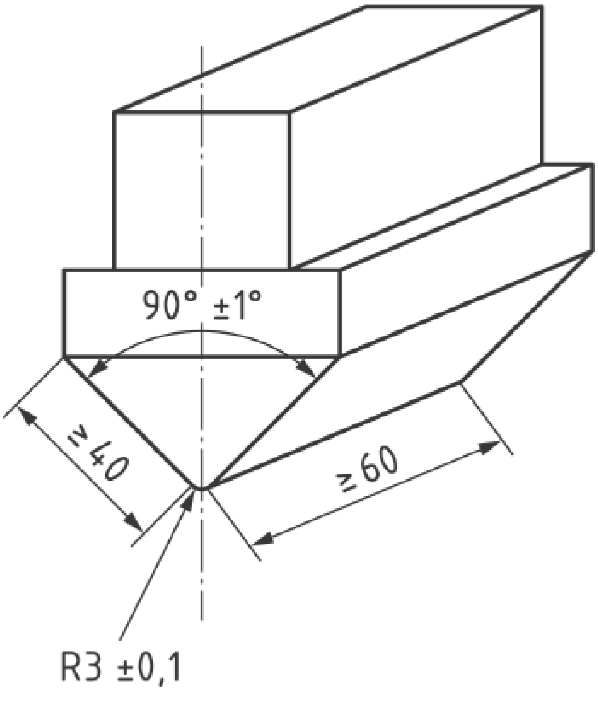


Fig. C-1 Impact Striker

C-1.3 Modelling Clay Cylinders

Diameter 25 mm ± 2 mm; height 28 mm ± 2 mm for metallic toecaps of size up to and including 5, and height 30 mm ± 2 mm for metallic toecaps having size above 5. The flat ends of the cylinder shall be covered with aluminium foils to prevent from sticking to either the test piece or the test equipment.

The modelling clay shall fulfil the requirements given in Annex G.

C-1.4 Dial Gauge

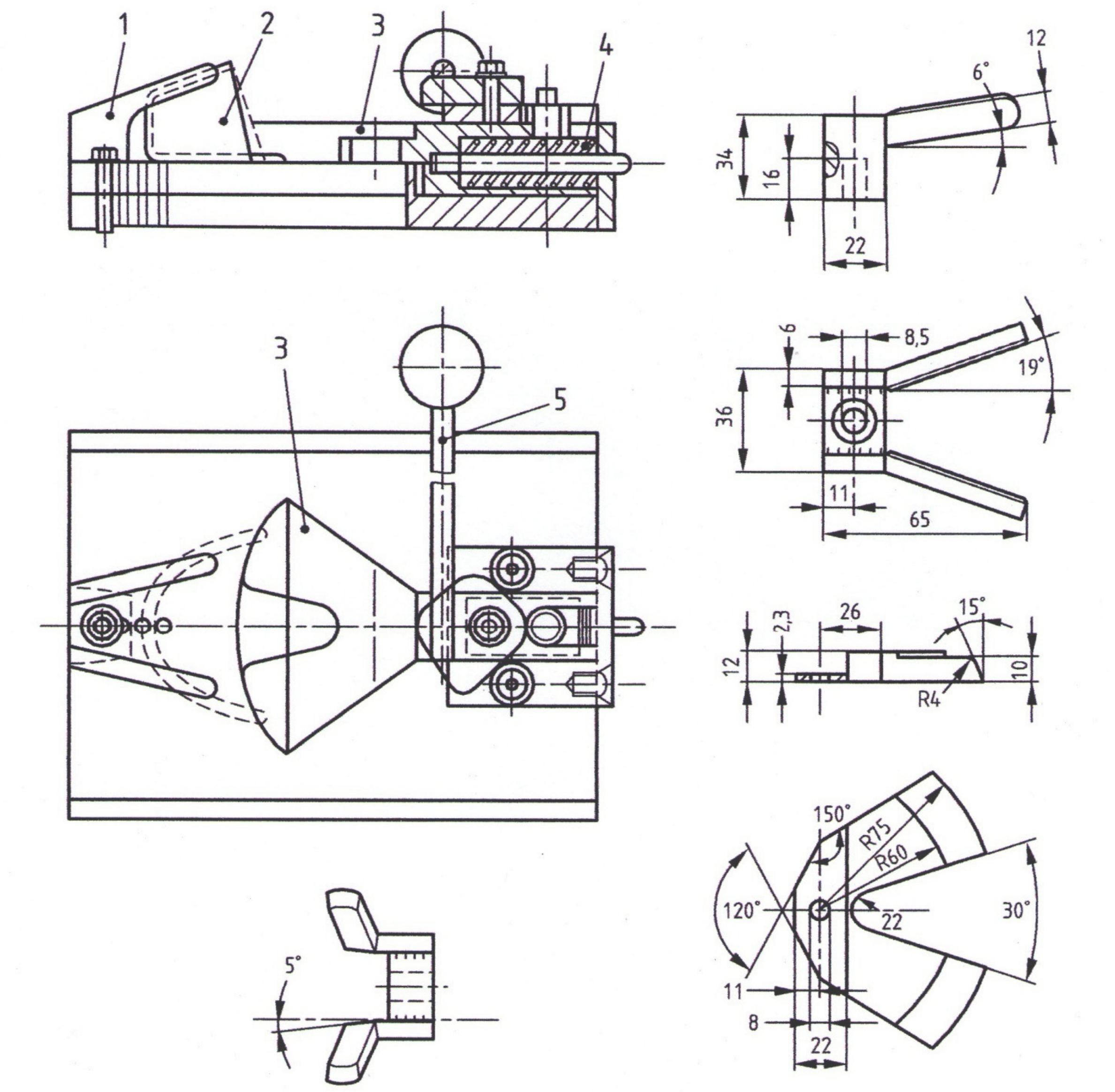
With an accuracy of 0.1 mm, working in a vertical sense, with a flat base to place the clay cylinder on, and a hemispherical upper sensor of 3.0 mm ± 0.2 mm radius exerting a vertical force of not greater than 250 mN.

C-2 PROCEDURE

Determine the test axis as described in **A-1**.

Use the metallic toecap as the test piece.

Dimensions in millimetres



Key

1 Forked clamp

2 Toe cap

3 Radiused plate

4 Spring

5 Clamping handle

FIG. C-2 EXAMPLE OF SUITABLE DESIGN OF METALLIC TOECAP CLAMP

Hold the test piece in the clamping device (**C-1.2**) so that when the striker hits it, the striker will project over the front and back of the metallic toecap.

Position a cylinder (**C-1.3**) under the rear upper edge of the test piece in such a way that approximately 2/3rd of its diameter is within the test piece and 1/3rd of its diameter is protruding behind the rear edge and the centre of the cylinder matches the test axis as closely as possible (*see* Fig. C-3). At the time of the test, the temperature of the modelling clay shall be between 18 °C and 25 °C.

Allow the striker to drop onto the test axis from the appropriate height to give an impact energy of 200 J ± 4 J (for metallic toecaps designed for safety footwear) or 100 J ± 2 J (for metallic toecaps to be used in protective footwear).

Measure, to the nearest 0.5 mm, the lowest height to which the cylinder has been compressed, using the dial gauge (**C-1.4**). This value is the clearance at the moment of impact.

C-3 TEST REPORT

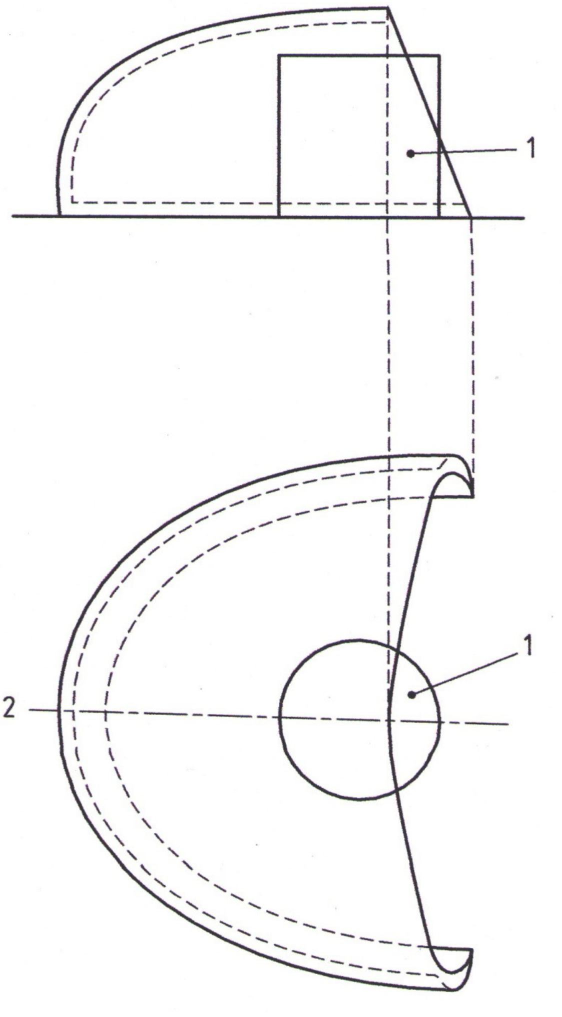
The report shall include the following information.

a) A reference to this standard [that is, IS 5852 (Part 1)];

b) All the details concerning the necessary information for the samples identification;

c) The clearance determined according to **C-2** for each size (right and left) of measured metallic toecap; and

d) Any deviation by agreement and otherwise of the present test method.



Key

1 Modelling clay cylinder
2 Test axis

Fig. C-3 Position of Cylinder for Impact or Compression Testing of Metallic Toecaps

ANNEX D

(*Clause* 4.4)

DETERMINATION OF COMPRESSION RESISTANCE

D-1 APPARATUS

D-1.1 Compression Testing Machine

Capable of subjecting the test piece to a force of at least 20 kN (to a tolerance of ± 1 percent) between two plain platens, by moving one of those at a speed of 5 mm/min ± 2 mm/min.

Both platens shall cover at least an area of diameter 150 mm, shall have minimum hardness of 60 HRC and shall remain parallel during the application of the load. Any effect of eccentrically applied forces to the measurement shall be excluded as far as possible.

D-1.2 Modelling Clay Cylinders

As described for the impact test (*see* **C-1.3**).

D-1.3 Dial Gaug1e

As described for the impact test (*see* **C-1.4**).

D-2 PROCEDURE

Determine the test axis as described previously (*see* **A-1**).

Use the metallic toecap as the test piece.

Position the test piece between the platens of the compression machine (**D-1.1**). Position a cylinder (**D-1.2**) under the rear upper edge of the test piece in such a way that approximately 2/3rd of its diameter is within the test piece and 1/3rd of its diameter is protruding behind the rear edge and the centre of the cylinder matches the test axis as closely as possible (*see* Fig. C-3). At the time of the test, the temperature of the modelling clay shall be between 18°C and 25°C.

Compress the test specimen to a load of either 15 kN ± 0.15 kN (for metallic toecaps to be used for safety footwear) or 10 kN ± 0.1 kN (for metallic toecaps to be used for protective footwear) (*see* Fig. D-1).

Reduce the load, remove the cylinder and measure, to the nearest 0.5 mm, the lowest height to which the cylinder has been compressed, using the dial gauge **(D-1.3)**.

NOTE — This value is the compression clearance at the moment of highest compression.

D-3 TEST REPORT

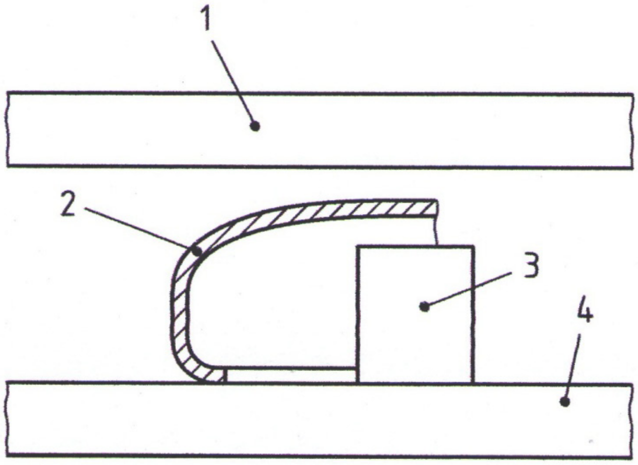
The report shall include the following information.

a) A reference to this standard [i.e. IS 5852 (Part 1)];

b) All the details concerning the necessary information for the samples identification;

c) The height determined according to **D-2** for each size (right and left) of measured metallic toecap; and

d) Any deviation by agreement and otherwise of the present test method.



Key

1 Upper platen

2 Toe cap

3 Modelling clay cylinder

4 Lower platen

Fig. D-1 Apparatus for Compression Test

ANNEX E

(*Clause* 4.5)

DETERMINATION OF CORROSION RESISTANCE

E-1 PRELIMINARY EXAMINATION

Examine the surface of metallic toecap visually (both inside and outside) for signs of corrosion under the coating and for corrosion occurring where the coating has broken down.

Measure the longest distance across each area of corrosion and note the number of such areas.

E.2 CORROSION TEST PROCEDURE

Remove any grease, silicone, wax or similar material which might be present on the surface with soft paper or textile, with ethanol if needed, and examine the cleaned surface for any sign of corrosion, longest dimension and no. of such corrosion, if present.

Prepare at least 300 ml of a 1 percent (mass fraction) aqueous solution of sodium chloride as the test solution. Pour it into a dish having size at least 100 mm × 160 mm. The depth of the solution shall be ≥ 15 mm and the gap between the level of solution and the glass plate shall be ≤ 10 mm. Cover the dish with a glass plate leaving a small opening.

Dip two strips of white filter paper of dimensions at least 100 mm wide and 150 mm long into the test solution at one end so that the strips of filter paper become saturated with solution, the other ends being laid on the glass plate.

Lay the metallic toecap sample with flange down over the free end of one filter paper so that the whole flange is in contact with the wetted area and lay the other filter paper over the metallic toecap so that the greatest possible area of the nose of the cap and its upper surface is in contact with the filter paper (*see* Fig. E-1). Ensure that the filter paper remains saturated with solution throughout the test.

After 48 h remove the filter paper and examine the metallic toecap for signs of corrosion. Measure the longest distance across each area of corrosion and note the number of such areas.

E-3 TEST REPORT

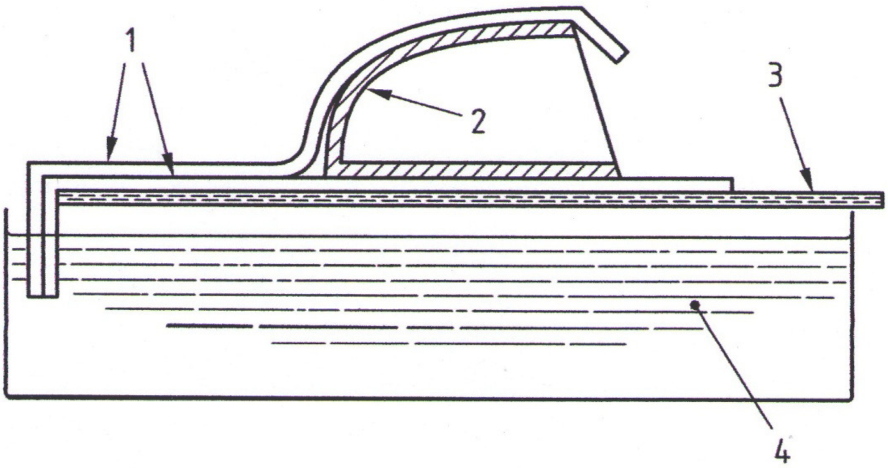
The report shall include the following information:

a) A reference to this standard [that is, IS 5852 (Part 1)];

b) All the details concerning the necessary information for the samples identification;

c) The longest distance across areas of corrosion determined according to **E-2** for each metallic toecap; and

d) Any deviation by agreement and otherwise of the present test method.



Key

1 Filter paper
2 Toe cap
3 Glass plate
4 Sodium chloride aqueous solution

FIG. E-1 SCHEMATIC VIEW OF THE CORROSION TEST ON METAL METALLIC TOECAPS

ANNEX F

(*Clause* 7)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

F-1 SCALE OF SAMPLING

F-1.1 Lot

All protective steel toe caps in a consignment shall be grouped together in pairs of the same type and size toconstitute a lot.

F-1.2 The conformity of the toe cap to the requirements of this specification shall be ascertained for each lot separately. A pair of toe caps shall be the unit of sampling. The number of pairs to be selected from each lot shall be in accordance with column 3, 5 and 6 of Table F-1.

F-1.3 These pairs of toe caps shall be selected at random from the lot. If the toe caps are packed in a number of boxes, at least 20 percent of the boxes shall be opened and equal number of pairs shall be selected from each box to constitute the required sample.

F-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

F-2.1 All the toe cap pairs selected under F**.1.2** shall be examined for shape, design and dimensions. A pair shall be termed as defective if one or both of the toe caps fail to satisfy the requirements for shape, design and dimensions. The lot shall be accepted as conforming to the requirements if the number of defective pairs found does not exceed the permissible number of defective pairs given in column 4 of Table F-1.

F-2.2 For examining the lot in respect of impact test, the number of finished toe cap pairs to be tested is given in column 5 of Table F-1. There shall be no failure if the lot is deemed to be satisfactory for performance requirements.

Table F-1 Scale of Sampling and Permissible Number of Defective Pairs

(*Clauses* F-1.2, F-2.1 *and* F-2.2)

Sl No.	Lot Size	For Shape and Dimension		No. of Toe Cap Pairs Tested for Impact and Compression Test	No. of Toe Cap Pairs Tested for Corrosion Test
		No. of the Steel Toecap Pairs	Permissible Number of Defective Pairs		
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to 50	5	0	1	3
ii)	51 to 200	8	0	2	3
iii)	201 to 500	13	1	2	3
iv)	501 to 1 000	20	1	3	3
v)	1 001 to above	32	1	3	3

ANNEX G

(*Clause* C-1.3)

IMPACT AND COMPRESSION TEST, MODELLING CLAY CHECK METHOD

G-1 SCOPE

This appendix describes the requirements and test methods for selecting modelling clay material suitable to be used as an auxiliary material for the testing of toecaps according to **C-1.3.**

G-2 REQUIREMENTS

G-2.1 Static Test

When tested in accordance with the method described in **G-3**, the modelling clay shall fulfil the following requirements:

a) The energy absorption, E_A, shall not be higher than 0.80 J; and

b) The elastic recovery, E_R, shall be between 0 percent and 5 percent.

G-2.2 Dynamic Test

When tested in accordance with the method described in **G-4**, the modelling clay thickness after the impact shall not be less than 15 mm.

G-3 STATIC TEST

G-3.1 Equipment

G-3.1.1 A compression machine equipped with two parallel plane plates, a load cell with a measuring range between 500 and 5 000 N and suitable means of measuring the amount of energy absorbed by the modelling clay cylinder during the test.

G-3.1.2 A stable spacer, capable of stopping the movement of the compression machine when the two plates have reached a distance of 15 mm ± 1 mm. A steel ring with an inner diameter "d" of $\geq$ 50 mm and an outer diameter of $\geq$ d + 10 mm is suitable.

G-3.1.3 A mould press or other suitable device for preparing modelling clay cylinders of the required dimensions.

G-3.1.4 A dial gauge conforming to IS 15298 (Part 1), clause **5.4.1.4**., with exception of the "anvil", which has to be flat.

G-3.2 Test Pieces

The modelling clay test piece must be cylindrical with both height and diameter of 25 mm ± 1 mm. The 2 flat surfaces shall be covered with an aluminium foil of $\leq$ 0.05 mm thickness.For each determination, at least three test pieces shall be tested.

G-3.3 Conditioning

The readily prepared test pieces shall be conditioned for at least 5 hin conditioned atmosphere of 27°C ± 2°C and 65 percent R.H. ± 5 percent R.H. Preferably the testing climate should be the same, otherwise testing has to be started within 3 minutes after removing each single sample from the conditioning chamber.

G-3.4 Testing Procedure

G-3.4.1 The initial height of the spacer shall be measured, and the initial height of each test piece has to be measured after conditioning and before testing. Both dimensions are to be recorded nearest to 0.1 mm.

G-3.4.2 After having positioned the spacer in the centre of the lower plate of the compression test machine, place the cylindrical test piece vertically onto the centre of this plate, avoiding carefully, as far as possible, any deformation of the test piece.

G-3.4.3 Start the machine and move the upper plate as fast and as close as possible to the test piece, without touching it.

G-3.4.4 Start the compression test with a uniform speed of 10 mm/min ± 2 mm/min.

G-3.4.5 Right after the upper plate has stopped its course when touching the rigid spacer, open the plates at a speed of at least 100 mm / min.

G-3.4.6 Allow the test piece to be idle and free for a period of 11 min ± 1 min in the conditioned atmosphere (**G-3.3**), maintaining the same upright position like in the compression machine; move the test piece as less as possible, avoiding application of any pressure or stress which could cause deformation.

G-3.4.7 Using the dial gauge, measure to the nearest tenth of mm, the final height of the test piece as close as possible to its axis or, in case of an uneven upside surface, at its highest point.

G-3.5 Expression of the Results

Calculate and / or record in Joule the energy absorbed, E_A, by the test piece during the test. Calculate and record the percentage of elastic recovery of the test piece, using the following formula:

$$E_R = \frac{(H - S) \times 100}{S}$$

Where,

H = final height of the test piece, and

S = initial height of the spacer.

The final results of both energy absorption and elastic recovery are calculated as average of the data obtained from 3 test pieces.

G-4 DYNAMIC TEST

G-4.1 Equipment

G-4.1.1 *Impact Apparatus*

Incorporating a steel striker of mass 1 kg ± 0.01 kg adapted to fall freely on vertical guides from a predetermined height of 40.7 cm ± 0.2 cm to give the required impact energy calculated as potential energy (*see* Fig. G-1). At the impact the speed shall 2.9 m/s ± 0.2 m/s.

The base of the apparatus shall be of compact design, avoiding any deformation as far as possible. The apparatus shall be free standing on a flat and level floor which is sufficiently large and rigid to support the test equipment. Provision shall be made for a mechanism to arrest the striker after first impact so that the test specimen is hit only once.

G-4.1.2 *Dial Gauge*

With an accuracy of 0.1 mm, working in a vertical sense, with a flat base to place the clay cylinder on, and a hemispherical upper sensor of (3.0 ± 0.2) mm radius exerting a vertical force of not greater than 250 mN.

G-4.2 Test Pieces

The modelling clay test piece must be cylindrical with a height of 29 mm ± 1 mm and diameter of 25 mm ± 1 mm. Both upper and lower flat surfaces shall be covered with an aluminium foil of ≤ 0.05 mm thickness. For each determination, at least three test pieces shall be tested.

G-4.3 Conditioning

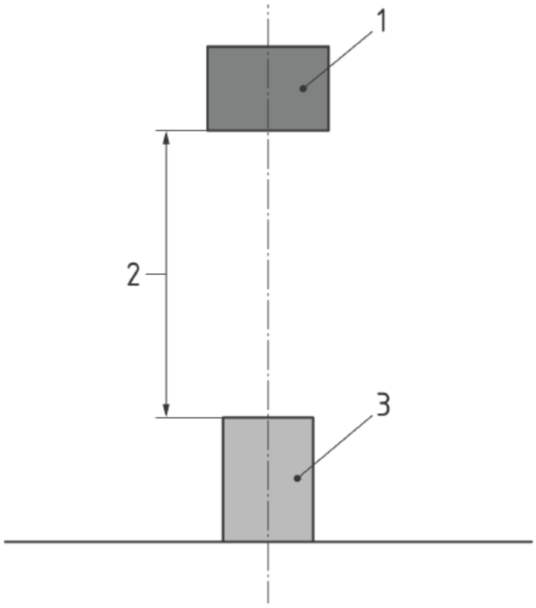
The readily prepared test pieces shall be conditioned for at least 5 hours in an atmosphere of 27°C ± 2°C and 65 percent R.H ± 5 percent R.H. Preferably the testing climate should be the same, otherwise testing has to be started within 3 min after removing each single sample from the conditioning chamber.

G-4.4 Testing Procedure

Position co-axially the sample and the striker (*see* Fig. G-1).

Allow the striker to drop on the sample freely.

Measure, to the nearest 0.5 mm, the lowest height to which the cylinder has been compressed, using the dial gauge (**G-4.1.2**). The final result is calculated as average of the data obtained from 3 test pieces.



Key

1 Striker, diameter (30±1) mm, weigh 1 kg
2 height of fall (40.7 ± 0.2) cm
3 modelling clay test piece, height of 29±1 mm and diameter of (25±1) mm

FIG. G-1 PRINCIPLE OF THE DYNAMIC TEST

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